



TEHRAN UNIVERSITY
OF
MEDICAL SCIENCES

Faculty of Health Lesson Plan

Lesson information:

Educational group providing the course: School Of Public Health
Course title: Biochemistry of microorganisms
Course code: 03
Type and number of units: 2 units (1.5 theoretical units + 0.5 practical units)
Name of the person in charge of the course: Dr. Ronak Bakhtiari
Instructor/ Instructors: Dr. Ronak Bakhtiari
Prerequisites/simultaneous: none
Field and level of education: Master's degree

Course instructor information:

Academic rank: Associate Professor
Specialization: Medical microbiology
Workplace: School Of Public Health
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General description of the course (it is expected that the person in charge of the course, while providing a general explanation, will describe the different content parts of the course in the form of one or two paragraphs):

The course "Biochemistry of Microorganisms" examines the structure and biochemical function of microorganisms, including bacteria and fungi. The topics of this course include knowledge of enzymes, metabolic pathways, and specific biochemical reactions that occur in these organisms. This course is a combination of theoretical and practical sessions and its purpose is to gain a deeper understanding of biochemical processes and their industrial and research applications. Students analyze microbial samples using laboratory methods.

General goals/ axes of competence:

The general goals of the "Biochemistry of Microorganisms" course include empowering students in the following areas:

- The general goal of the course is to familiarize with the basis of biochemical tests in connection with the laboratory diagnosis of microorganisms
- Familiarity with the structure and biochemical function of microorganisms: including enzymes, metabolites and specific biochemical reactions.
- Understanding microbial metabolic processes: including catabolism and anabolism, as well as energy generation and biosynthesis pathways.
- Laboratory data analysis: including the design and implementation of experiments to investigate biochemical processes in microorganisms.
- Practical and industrial applications: including the use of microorganisms in biotechnology, industrial and pharmaceutical products.

Specific goals/ sub-themes of each ability:

- After completing the course "Biochemistry of Microorganisms", learners are expected to have acquired the following abilities:
 - - Identification and diagnosis of microorganisms: learners should be able to identify and diagnose different types of microorganisms using different biochemical tests.
 - - Understanding the metabolic mechanisms of microorganisms: Learners should be able to explain different metabolic mechanisms in microorganisms, including the processes of fermentation and respiration.
 - - Application of laboratory techniques: learners should have the ability to use laboratory techniques related to the biochemistry of microorganisms, including conducting and interpreting biochemical experiments.
 - - Laboratory data analysis: learners should have the ability to analyze data obtained from biochemical experiments to recognize and interpret the biochemical characteristics of microorganisms.

- Interpretation of results based on biochemical reactions: learners should be able to interpret the results of various experiments based on biochemical reactions in microorganisms.

Educational approach: virtual face-to-face combined

Teaching-learning methods according to the selected educational approach:

Face-to-face approach

- Interactive lecture (question and answer, quiz, group discussion, etc.)
- Discussion in small groups
- Role playing
- Guided exploratory learning
- Team Based Learning (TBL)
- Problem-based learning (PBL)
- Scenario-based learning
- Using students in teaching (teaching by peers)

Lesson calendar:

Session	Subject title	Teaching method	Date	Teacher's name
1 Theory	Introduction and general biochemistry of microorganisms The importance of biochemical tests in microbiology Acquaintance with culture media required in common microbiology experiments How to prepare and maintain cultivation environments	face-to-face	Tuesday 8-10	Dr. Bakhtiari
1 Practical	Familiarity with laboratory equipment Practical demonstration of preparation of culture medium	face-to-face	Tuesday 8-10	Dr. Bakhtiari
2 Theory	Reagents: types, preparation and storage Mechanism of action of important reagents	face-to-face	Tuesday 8-10	Dr. Bakhtiari
2 Practical	Bileesculine hydrolysis test	face-to-face	Tuesday 8-10	Dr. Bakhtiari
3 Theory	General principles of conducting biochemical experiments How to interpret test results	face-to-face	Tuesday 8-10	Dr. Bakhtiari
3 Practical	CAMP test Sugar intake test	face-to-face	Tuesday 8-10	Dr. Bakhtiari
4 Theory	Acquaintance with alternative and complementary tests Rapid tests available to help with immediate treatments	face-to-face	Tuesday 8-10	Dr. Bakhtiari
4 Practical	Oxidation and reduction (OF) test Catalase and peroxidase test	face-to-face	Tuesday 8-10	Dr. Bakhtiari
5 Theory	A review of carbohydrate metabolism in bacteria Importance of carbohydrate metabolism tests in bacterial diagnosis	face-to-face	Tuesday 8-10	Dr. Bakhtiari

Session	Subject title	Teaching method	Date	Teacher's name
5 Practical	Citrate consumption test as sole carbon source	face-to-face	Tuesday 8-10	Dr. Bakhtiari
6 Theory	Metabolism of proteins and amino acids in bacteria The importance of tests related to the metabolism of proteins in the diagnosis of bacteria	face-to-face	Tuesday 8-10	Dr. Bakhtiari
6 Practical	Coagulase test (tube method and slide method) Decarboxylation test (lysine, ornithine, arginine)	face-to-face	Tuesday 8-10	Dr. Bakhtiari
7 Theory	Bacterial enzymes and their role in diagnosis Principles of enzyme tests	face-to-face	Tuesday 8-10	Dr. Bakhtiari
7 Practical	Arginine dehydrolase test DNase and thermonuclease (TNase) test	face-to-face	Tuesday 8-10	Dr. Bakhtiari
8 Theory	Lipid metabolism in bacteria The importance of tests related to lipid metabolism in the diagnosis of bacteria	face-to-face	Tuesday 8-10	Dr. Bakhtiari
8 Practical	Galactosidase tests (PNPG, ONPG) Gelatinase test	face-to-face	Tuesday 8-10	Dr. Bakhtiari
9 Theory	Gas and acid production by bacteria Diagnostic importance of tests related to gas and acid production	face-to-face	Tuesday 8-10	Dr. Bakhtiari
9 Practical	Gluconate oxidation test Hippurate hydrolysis test H ₂ S production test	face-to-face	Tuesday 8-10	Dr. Bakhtiari
10 Theory	A review of important biochemical tests in the diagnosis of bacteria summary and Conclusion	face-to-face	Tuesday 8-10	Dr. Bakhtiari
10 Practical	Endol test A practical review of the tests performed	face-to-face	Tuesday 8-10	Dr. Bakhtiari

Duties and expectations from the student (this refers to the general duties of the student during the course. Duties and expectations such as regular attendance in the classroom, completing assignments on time, studying the introduced resources and actively participating in class programs)

- ✓ **Attending class on time**
- ✓ **Participation in class discussions**
- ✓ **Review the provided resources**

Student evaluation method:

- Mention the type of assessment (formative/cumulative)
 - Mention the student evaluation method
 - Mention the evaluation contribution of each method in the student's final grade
- ✓ **Formative (constructive) evaluation:** evaluation of the student during the course by mentioning the activities that the student performs independently or with the teacher's

guidance. This type of assessment can be done with the sole purpose of providing corrective feedback and fixing the student's weaknesses and strengthening the student's strengths. For example: carrying out various projects, periodical diagnostic tests, mid-semester tests such as class worksheets and class quizzes.

- ✓ **Summative (final) evaluation:** It is the student's evaluation at the end of the course, which, for example, can include the following:
 - Written, oral or practical tests by mentioning the types of tests, for example, written tests including closed-answer written tests such as "multiple-choice", "extensive sorting", "true-false" and test Open-answer written tests, both descriptive and short-answer, argumentative tests such as key features test, scenario writing by creating hypotheses, etc., practical tests that, for example, can include a variety of objective structured tests. such as OSCE, OSLE, etc., or workplace-based evaluation using tools such as DOPS, logbook, portfolio, 360 degree evaluation, etc.

How to evaluate	Score percentage
Active attendance and participation in class	3 marks
midterm exam	7 marks
End of semester exam	10 marks

References:

References include textbooks, specialized publications, articles and related websites.

Cohen, Georges N. *Microbial biochemistry*. Vol. 500. Dordrecht: Springer, 2011.